

(19)



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(11)

**EP 0 761 396 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
12.03.1997 Bulletin 1997/11

(51) Int Cl.<sup>6</sup>: **B26D 3/16**(21) Application number: **96306478.7**(22) Date of filing: **06.09.1996**

(84) Designated Contracting States:  
**DE ES FR GB IT**

- Perez, Ramon Calisto  
Bristol, Pennsylvania 19007 (US)
- Jerman, Robert Edward  
Chalfont, Pennsylvania 18914 (US)

(71) Applicant: **ROHM AND HAAS COMPANY**  
Philadelphia, Pennsylvania 19106-2399 (US)

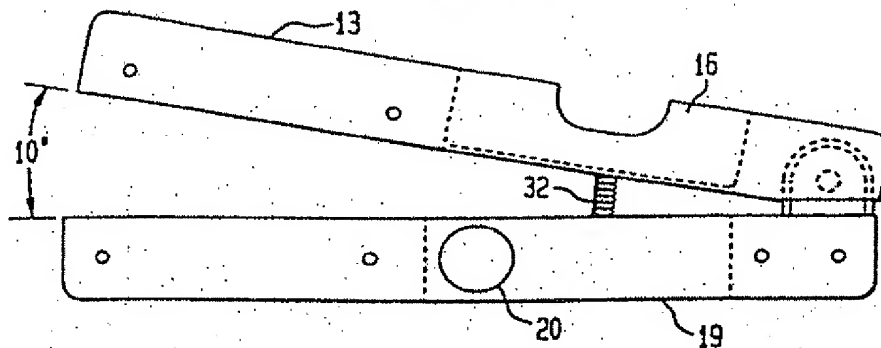
(74) Representative: **Angell, David Whilton et al**  
**ROHM AND HAAS**  
European Operations Patent Department  
Lennig House  
2 Mason's Avenue  
Croydon CR9 3NB (GB)

(72) Inventors:  
• Bigley, Andrew Bruce Walter, Jr.  
Levittown, Pennsylvania 19055 (US)  
• Ludwig, Edward G., Jr.  
Yardley, Pennsylvania 19067 (US)

(54) **Hand held tube severing device**

(57) A hand-held device for severing flexible polymeric tube, pipe, or tubular extrudate, especially flexible light pipe, reproducibly and cleanly is described. The device comprises a block (14) with holes (20) or openings for holding the pipe and a slit for guiding the severing

blade with minimum deviation from its path. An improved design employs a pivot in the block upon which a notched blade in a holder (12) may be mounted to give even more accurate and uniform control of the severing process.

**FIG. 5****EP 0 761 396 A1**

## Description

The present invention relates to a hand-held device for severing a flexible organic polymer, especially an organic polymer flexible light pipe, in a uniform and clean manner, allowing for efficacious rejoining of severed segments during further processing or fabrication.

Light pipes have applications in industrial, commercial and residential lighting where it is desirable to direct light from a single source to one or more remote locations. In a light pipe system, the light is transmitted from the source to the desired location by means of one or more light pipes. Light pipes or optical guides or optical fibers vary in length and diameter depending upon particular applications. For example, light pipes may have a diameter as small as 0.001 inch (25.4 microns). The largest commercially available polymer-based solid core light pipes have a diameter of about 1 inch (2.54 cm). While larger diameters of light pipes may be used, a 1 inch diameter (or less) is sufficient for most applications and light from a typical commercial light source may be readily focused onto a 1 inch light pipe. Solid core light pipes, herein abbreviated FLP for Flexible Light Pipe, commonly have one or more layers of light-reflective or coating materials, made of a flexible and chemically resistant material, over a flexible light-conducting core. The light-reflective material is next to the solid core, often is a fluoropolymer, and is called "cladding"; the outer material is a sheathing, often made of a polyolefin.

For making a light pipe system as versatile as possible, the FLP will often be used in multiple segments, requiring connection through appropriate coupling devices from the light source, at locations where the light may be led into various branch light pipes, and finally coupled to a lens or other device for utilizing the transmitted light for illumination, wherein segments of the light pipe need to be connected efficaciously directly to each other, or through a coupler, or to the light source or the final light output, with minimal light loss at each connection.

To prepare couplings with minimum loss of light whilst avoiding refractive-indexed matched liquids or adhesive in the couplings, it is necessary that the FLP have clean cut surfaces (i.e., a flat surface with no tear marks or irregularities), usually perpendicular to the pipe (which is normally in cylindrical form -- if ovoid or irregular, the cut would be perpendicular to the center line of the extended FLP). Without extreme care, it is difficult to sever a FLP with a soft or semi-liquid core, without tearing of the surface or production of an irregular cut area; such tearing often occurs with devices such as razor blades, knife blades in holders, blade-type "paper cutters" and the like.

There exists a molded plastic apparatus, designed for severing solid rubber cylindrical stock into O-rings, with a perpendicular slit through which a razor blade may be inserted, but it does not hold the light pipe steady

enough for repetitive cuts which are clean and uniform.

Matsumoto, U. S. Patent 5,012,579, describes a severing machine for synthetic resin pipes which involves an improved method for applying uniform pressure to the blade during the severing process. The device appears to entail no means for tightly holding and aligning the pipe to be cut and thus assure accuracy and reproducibility during the severing process. Further, the device requires means to drive the apparatus, which makes it awkward for repetitive use in an environment where electric power is not readily available. Further, the device of Matsumoto is too large and bulky to be used in a hand-held manner. Thus, there is no hand-held device which will hold the pipe in a steady manner, hold it in a form where the cut is perpendicular, and perform a rapid, clean cut with no tearing to leave a smooth perpendicular surface.

We have developed such a device, useful in hand-held severing operations, but also suitable for bench-top use, which overcomes the deficiencies of the prior art devices. The device is for cleanly severing a flexible polymeric tube, pipe, light pipe, or tubular extrudate (herein abbreviated FPTPLPOTE), preferably a flexible polymeric optical light pipe, to yield reproducibly a severance of the FPTPLPOTE, the severing device comprising:

a) means for holding the FPTPLPOTE to be severed in a linearly extended manner so that the surface of the FPTPLPOTE is fixed in position to the plane swept by the severing means, the holding means not interfering with the path of the severing means, the holding means comprising:

- (1) a holding block with one or more holes completely through the block, the holes being of a size slightly larger than the FPTPLPOTE to be severed, so as to hold firmly the linearly extended FPTPLPOTE when introduced through the holes, the holes preferably being of uniform diameter or of uniform cross-sectional size;
- (2) a slit in the block completely surrounding the holes, i.e., the cylinder which is the surface of the holes being completely sliced through by the slit;
- (3) one or more pivots attached to the block, the pivot being located at a point in the block wherein the plane swept by the severing means will engage the complete cross-sectional area of one or more holes;

b) severing means comprising

- (1) a blade of sufficient sharpness to sever cleanly the FPTPLPOTE, the blade being of a thickness slightly smaller than the width of the slit, preferably the difference between the thickness of the blade and the width of the slit being

from about 0.001 to about 0.010 inches, the blade being of a size to fill the slit at least through the cross-sectional area of the hole in which the flexible polymeric tube, pipe, or tubular extrudate is introduced;

(2) a holder for the blade which clamps the blade securely, the holder further containing means for contacting the pivot in the block, permitting movement of the holder around the pivot within the plane of the severing means.

One embodiment of the device is shown in Figures 1 and 4. A second embodiment is shown in Figures 5 - 14.

Preferred embodiments of the invention, applicable to severing of all types of flexible polymer pipe, but especially for the severe requirements of severing flexible optical light pipe, involve the use of a blade which is coated with a lubricating fluoropolymer, such as polytetrafluoroethylene. Such a coating, which includes any coating or film having a low coefficient of friction, avoids the need to apply an external lubricant frequently. For ease and safety of replacement, a single-edge razor blade is preferred, and especially preferred, for ease of clamping securely, is a razor blade which contains a reinforcing strip across the top of the blade, the severing edge of the blade being at the bottom.

To hold the blade immobile, it is preferred further that the holder contains means, such as tightening bolts or cap screws, for applying pressure perpendicular to the razor blade surface to render said blade immobile relative to the holder.

For best control of the path of the severing blade, it is preferred to use a razor blade which contains notches at each side of the blade, said notches being centered from about one-fourth to about three-fourths of the distance between top and bottom of the blade. Such notches are engaged in the block as follows: the block further contains one or more pivots; each pivot being aligned perpendicular to the slit, each pivot being located at a point in the block wherein the plane swept by the severing means swiveling on the pivot will engage the complete cross-sectional area of one or more holes, and each pivot being of a size slightly smaller than the notches of the razor blade. The pivot is engaged by one of the notches. When so engaged, the holder is constrained to swing in an arc which allows the severing edge to descend upon and cleanly slice the light pipe to be severed, but not to contact any hard surface which would dull the blade.

A second preferred design which eliminates the possibility that the blade holder can be separated from the holding block comprises the pivot attached to the block being a permanent pivot, the holder of the severing means also being attached permanently to the pivot and aligned so that the blade will pass through the slit when the severing device is activated.

Further safety measures include construction of the

blade holder and holding block with embodiments which will prevent the holder from being lifted high enough to expose openly the blade edge to human contact while the blade is attached to the holder, and further wherein the blade in a resting position is held so that the hole is fully open for introduction of the flexible polymeric tube, pipe, or tubular extrudate. The embodiments which accomplish will prevent the holder from being lifted high enough to expose the blade edge include (a) designing the blade holder so that the blade is held tightly in place and, when changing is required (as is necessary to maintain a sharp edge), removing the blade from the side of the blade holder which does not present the blade edge for cutting, such as by handling the single edge blade by the non-sharpened edge, which usually will have a thickened portion; (b) having a latch, spring, hook, or similar device to hold the blade edge within the holder when transporting; (c) having the blade edge never able to extend beyond the bottom edge of the block, (d) constructing the holder so that it cannot be raised above the top of the holding block far enough to expose the blade edge, which may be accomplished by appropriate design of the holder and/or pivot.

To maintain the blade in a resting position is held so that the hole is fully open for introduction of the flexible polymeric tube, pipe, or tubular extrudate may be accomplished by use of an appropriate spring located near the pivot, mounted on or in the block, and contacting the blade holder, the spring being of sufficient resistance to hold the holder high enough so that the hole is not blocked by the blade, but of low enough resistance that the application of a force to the blade holder will drive the blade through the FPTPLPOTE to be severed.

Generally the cut in the FPTPLPOTE will be perpendicular to the surface, and in most cases will further result in a flat cut, that is the severed surface is perpendicular to the diameter line of the FPTPLPOTE. In the present device, the slit in the block will be aligned perpendicular to the surface of the FPTPLPOTE, and the pivot will be aligned perpendicularly to the slit. In the most utilized operation, the slit in the block will be aligned perpendicular to the diameter line of the FPTPLPOTE.

Versatility may be added to the device by the further addition of a rotatable dial containing holes of different sizes, which holes may be singly interfaced with a hole of similar or larger size in the block. This method allows for a smaller blade and a smaller area swept out by the blade, as well as assuring better alignment of the blade and holder during severance. Thus, the holding block further contains a rotatable dial, the dial containing one or more holes, the dial holes being of a size slightly larger than the FPTPLPOTE to be severed, so as to hold firmly the FPTPLPOTE when introduced through the dial holes, the dial being located so that the dial holes may be aligned with the hole or holes which are completely through the block. A locking device, such as sinks machined into the blade holder, which may be engaged by

a nylon ball plunger in the dial so as to hold the dial at one of several positions, but allow it easily to be released for guiding the position of the dial. The location of the sinks and the plunger may be reversed between block and dial.

Although designed to sever flexible optical light pipe which is a soft, flexible, sometimes semi-liquid core surrounded by a thin cladding of reflective polymer, such as a fluorocarbon polymer, and further usually surrounded by a protective sheathing of a relatively tough plastic, such as polyethylene, the device may also be used to sever other objects in FPTLPOTE form, such as elastomers, rubber tubing, plastic tubing, and the like, which are difficult to sever without tearing or spoiling the surface exposed by the severing. The device further alleviates the need to chill the object prior to cutting or severing. The device may be used to sever flexible light pipe which does not have an external protective sheathing. The device may be used to sever a bundled flexible light pipe, i.e., where several light pipes are bundled together within a single protective sheath.

The apparatus described herein, as illustrated by the drawings, is a specific embodiment of the broader invention; it will be apparent that alterations can be made in the design to accommodate the full inventive concept of the device. Except for the blade itself, it is possible for most or all of the components to be molded or formed from plastic as well as metal.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

This description relates to the specific severing of light pipe, but may be applied to other FPTLPOTE. Figure 1 shows the blade holder and blade mounted together. The blade holder (1) is aluminum, preferably machined 6061 aluminum. It is 3.25 inches long, 0.375 inches wide, and 0.5 inches high; a 2 inch long slit (2) is machined into the holder, of depth 0.28 inches and of width 0.015 inches; the slit width and height are tailored to securely hold the razor blade, especially with the use of the cap screws to prevent horizontal or vertical displacement. Two cap screws (3) are mounted in holes 0.25 inches and 0.75 inches respectively from the end of the block wherein the slit (2) has been cut. The cap screws are mounted deep enough so that they can clamp upon any blade mounted in the slit to hold it securely.

The blade (4) is a commercially available single-edge razor blade, coated with polytetrafluoroethylene. The blade is 1.5 inches in length, and 0.75 inches high. Its thickness is 0.009 inches. A notch (5) has been cut by the blade manufacturer in both sides 0.625 inches from the bottom or severing edge of the blade. A thicker metal cover (6), added by the blade manufacturer, is attached to the blade, of height about 0.238 inches and of thickness about 0.015 inches. As noted above, the slit width and height are so constructed that the blade can be easily inserted and removed, but will fit snugly.

The blade (4) is inserted into the slit (2) until about 0.375 inch of the blade extends beyond the edge of the holder (1). This distance need not be critical, as long as the plane of the severing device blade intersects fully with the holes in the block which hold the light pipe. The cap screws (3) are then tightened to hold the blade securely.

The block (7) is also machined 6061 aluminum. It is constructed from two pieces which are 4 inches long, 1 inch high and 0.375 inches deep. A three-inch long slit (8) is present in the center of the block (actually, very slightly off center) by milling out a three inch long portion of one piece to a depth of 0.009 inches. The two pieces of the block are fastened together by screws (9) at each corner, the screw mountings being 0.156 inches from the top surface and the side surface. A 0.125 inch pin (10) is present at each end of the block, mounted 0.25 inches from each end and 0.5 inches from each top surface; these pins aid in realignment after any disassembly and cleaning.

Four holes (11) for the insertion of light pipe are bored into the block, the center of each hole being 0.25 inches from the nearest top or bottom edge. The holes are bored for four common sizes of light pipe (9, 7, 5, and 3 mm.), at a diameter of 10 mm. (0.394 in.) (hole 11a), at 8 mm. (0.315 in.) (hole 11b), at 6 mm. (2.36 in.) (hole 11c), and at 4 mm. (0.157 in.) (hole 11d). Holes 11a and 11c are centered 1.625 inches from one edge and holes 11b and 11d are centered 2.375 inches from that same edge.

The four pivots (12a to 12 d) are formed of 7/64" (0.109 inches) pins mounted 0.625 inches from each edge and 0.156 inches from top or bottom. It can be seen that the pivot pins are within the section cut out to form the block slit (8).

Figures 5 and 11 show a version of the device with a single hole in the block and a permanently-mounted blade holder. For ease of construction, the blade holder (13) is made of two 0.25" aluminum pieces machined and then screwed together with flush screws through tapped holes (14). The blade holder is 4.5" long and 0.5" high. At (15), the blade holder has a piece removed beginning from the pivot space (15) at an angle of 10°, which is to prevent the assembled blade holder from being lifted more than 10° from the horizontal position (or the plane of the top of the holder). Alignment guides (not shown) may also be present in the blade holder to facilitate re-assembly when screws are removed, e.g., for cleaning.

A blade pocket is provided (16) which is 1.562" long, 0.038" wide, and 0.438" deep. The pocket begins 2.25" from the non-pivot end of the blade holder, and is centered within the blade holder. There is a rounded section (17) of 0.25" radius in the corner and 0.75" long, cut to allow fingers to grasp and remove or insert the blade; its center is 2.81" from the non-pivot end of the blade holder. The bottom of the pocket is slightly rounded (0.125" radius) at the corners (16a) to allow the single-

edged razor blade (4) to rest against the bottom of the pocket. Holes are tapped (16b) to receive tightening screws for holding the blade tightly in place.

A further slot (18) extends through the holder beneath the pocket (16); this slot is 0.009 inches wide, so that the razor blade cutting edge passes through the slot and fully through the hole in the block (20) and is available for severing purposes. The blade (4), when in place, will extend about 0.437" below the bottom of the blade holder.

A space (15) is machined for fitting over the pivot of the holder block (23). The space is at the bottom of the holder, and is 0.5" long and 0.25" wide. The height of the space (15) is defined by a semicircle of radius 0.25", whose center is located 0.312" from the top edge of the block; from the ends of the semi-circle, there is a straight drop to the bottom of the holder. The space (15) will contain a means for attaching to the pivot of the pivot block, such as a pivot pin passing through the pivot, requiring appropriately machined holes (15a) and fasteners.

The block (19) is also prepared from machined aluminum, and may be assembled from two mirror image pieces. When assembled, the block (19) is 0.5" wide, 0.5" high, and 4.5" long. In this design, only one hole (20) is bored; the center of the hole is 2.4375" from the non-pivot end, and 0.25" from the top of the block. The hole (20) is 0.364" (9 mm.) in diameter. Assembly screws (21) are present 0.25" from the top of the block and at 0.75", 1.75", and 4.25" from the non-pivot end of the block. Alignment guides may also be present (not shown for clarity) to facilitate re-assembly when screws are removed, e.g., for cleaning.

A slit (22) which allows the blade to pass through the block and completely pass through the hole is 2.156" from the non-pivot end of the block, is 1.625" long, is centered in the top of the block, and is 0.01" wide. The slit may extend through the whole body of the block, but it must be deep enough (at least 0.469") so the blade edge does not meet any portion of the block after severing the FPTPLPOTE.

The pivot block (23) is at the top of the block, and may be formed by machining it as part of each half of the block and then assembling the block halves; after assembly, it is 0.25" wide, is 0.5" long, and is 0.375" high. Its shape is of a hemi-cylinder on top of a rectangular block. The hemi-cylinder has a radius of 0.5", and the center of the hemi-cylindrical cross-section is 0.188" from the top surface of the block. At that center is placed a pivot means (23a) for assembling with the handle whose pivot slot fits over the pivot, such as a pivot pin passing through the pivot.

Figures 10-14 shows a modified block (24), wherein further attached to the block is a rotatable dial (25). This dial is 1.25" in diameter, is 0.125" thick, and has four dial holes (26) of differing diameters; in this case, of 3, 5, 7, and 9 mm. (0.118", 0.197", 0.276", and 0.354"). These dial holes are centered on lines which are at a 90° angle to each other on the face of the rotatable dial, and their

centers are each 0.5" from the center of the dial.

The dial is mounted so that it can be rotated so that each dial hole in turn may be moved so that the center of the dial hole is directly in line with the center of the block hole. Thus the dial pivot (27) is directly beneath the center of the block hole (20); a means, such as a dial pivot is used to attach the dial at this point (27) for further rotation. The size of the modified slit (28) is enlarged so that the dial (25) and dial pivot (27) can be inserted through the bottom of the block, and enough of the dial protrudes that it can be rotated readily.

The dial, when mounted for best efficiency in the center of the holder block, will have a dial slit (29) formed so that the blade edge will fit therein. The amount of the blade which will sever the object to be cut, yet not contact the edge with a metal surface is controlled by the design, so that the blade passes cleanly through the block holder slit (22) and the dial slit (29) and yet does not contact the dial pivot area (27). The dial slit is 0.009" wide. For ease of assembly, each half of the dial, with holes and cut-outs, may be machined separately and then assembled.

The holder block for the block containing the dial may allow means to contain a ball spring mounted in a hole at (30), the ball at the end of such spring able to contact and fit into indentations (31) on the rim of the dial, so as to hold the dial in place when cutting, yet allow it to be rotated by hand. The spring and indentations will be offset from the plane of the dial slit and holder slit.

The block (19 or 24) may also contain a spring (32) fitted in a spring hole (32a) located in the center of the block top, and located 1.5" from the pivot. The spring is selected to be of such resistance that when assembled the handle is held at a 10° angle relative to the plane of the top of the block; in this position, passage of FPTPLPOTE through the hole is unimpeded, yet the blade edge is not exposed to human contact. The spring must also be of such resistance that hand pressure on the handle will allow the blade holder to be lowered readily to cause the blade to pass through the FPTPLPOTE placed within the hole and sever it cleanly.

A catch to hold the handle in a down position for ease of carrying may be attached involving attachments to both holder and block (not shown for clarity).

The following exemplifies the use of the block and blade to improve the accuracy of the severing behavior, while Example 2 illustrates the use of the pivot and notch better to control the process of severing the light pipe. Example 3 illustrates the use of the cutter with the permanent pivot, while Example 4 illustrates the use of the cutter with the rotatable dial and single hole.

#### EXAMPLE 1

A block of molded polypropylene, is 4 inches long by 1.25 inches high by 0.625 inches thick and has a three-inch long slit molded of thickness about 0.009 inches wide, the slit passing through the body of the



block, in the manner of the slit (8) in Figure 3. Into this block are molded six holes of various diameters (0.375 inch, 0.313 inch, 0.25 inches; 0.188 inches; and two smaller), the top of each hole between 0.0625 inches, from the top surface of the block, and all holes passing perpendicularly through the block in the area where the slit is molded.

A piece of light pipe as formed by the teaching of U. S. Patent 5,406,641, and with a sheath of polyethylene, the thickness being 9 mm. (0.354 inches) is passed through the 0.375 inch-hole until the area to be severed is under the slit. The block and pipe are held immobile. A single-edge razor blade with a top protective edge is inserted through the slot and with a sweeping motion is employed to sever the light pipe. Although with care individual cuts or severings may be made which are clean, in a series of cutting or severing operations, the number of undesirable cuts is much higher than when the device of this invention is applied as in Example 2.

### EXAMPLE 2

The block and blade holder as shown in Figures 1 and 4 is employed as follows. The blade (4) is fastened into the blade holder (1), and the set screws (3) are tightened. The blade and holder are then inserted into the block (7) through the slit (8) until the notch (5) in the blade engages the pin (10). The blade can then be lifted free of the block by raising the holder handle, and can be lowered to sweep out the area of one of the holes (11); in this example, when the blade is inserted to contact pivot 12a, the plane of the blade will sweep through the cross-section area of hole 11a. For use with the other holes, the blade is inserted at the bottom and/or the holder reversed, so that the single mounting of the notched blade in the holder can be used to sever any of the thicknesses.

The blade holder is raised so that the blade does not impede passage of the light pipe through the hole. A piece of 9 mm. light pipe is inserted in hole 11a, until the point at which the light pipe is to be severed is directly underneath the slit. The light pipe fits snugly in the hole; the path of the blade is also constrained by the narrowness of the slit. The handle is lowered rapidly, and the blade severs the light pipe cleanly, as can be seen by an observation of the severed surface.

The blade edge may be the conventional shape as found in a commercial razor blade, where the two severing surfaces taper inwards at equal angles. These tapering edges may be slightly beveled. However, although well adapted for shaving, these blades do not give the best perpendicular cut for the cleanest surfaces, although the cuts are adequate for most purposes.

An improvement is to shape the blade so that one side of the blade is extended in a straight line in the plane of the cutting stroke, and the other edge is tapered to the desired cutting edge thickness. When mounted in the blade holder, the straight edge will face the portion

of the light pipe which requires the best surface. For example, if the severing device is used to trim the end of a piece of pipe prior to re-connection, then the flat edge of the blade will contact the new end cut on the pipe, while the tapered edge faces the small end piece which is removed and discarded.

### EXAMPLE 3

Figures 5 and 9 show a version of the device with a single block hole of 9 mm. (0.354") diameter in the block and a permanently-mounted blade holder. After fitting a standard Teflon-coated single edge blade into the blade holder by dropping it into the blade holder (16) from the top and tightening with tightening screws (16b), the blade holder will be resting in a position where passage of the FPTPLPOTE through hole 20 is not impeded. After passing the desired length of light pipe as formed by the teaching of U. S. Patent 5,406,641, and with a sheath of polyethylene, the total thickness of the light pipe being 0.354 inches (9 mm.) diameter, through hole (20), the blade handle is lowered to sever cleanly the light pipe.

### EXAMPLE 4

Figures 10-14 shows a version of the device with a rotatable dial (25). The dial is rotated so that a dial hole of 0.354" diameter is directly in line with the block hole of the same diameter. After passing the desired length of the light pipe of Example 1 through the two holes and fully through the block, the handle is lowered to cleanly sever the light pipe to yield a clean, even cut.

### Claims

1. A device for cleanly severing a flexible polymeric tube, pipe, light pipe, or tubular extrudate to yield reproducibly a severance of the flexible polymeric tube, pipe, light pipe or tubular extrudate, the severing device comprising:

a) means for holding the flexible polymeric tube, pipe, light pipe, or tubular extrudate to be severed in a linearly extended manner so that the surface of the polymeric tube, pipe, light pipe, or tubular extrudate is fixed in position to the plane swept by the severing means, the holding means not interfering with the path of the severing means, the holding means comprising:

(1) a holding block with one or more holes completely through the block, the holes being of a size slightly larger than the flexible polymeric tube, pipe, light pipe, or tubular extrudate to be severed, so as to hold firmly

the linearly extended flexible polymeric tube, pipe, light pipe, or tubular extrudate when introduced through the holes;

(2) a slit in the block completely surrounding the holes; 5

(3) one or more pivots attached to the block, the pivot being located at a point in the block wherein the plane swept by the severing means will engage the complete cross-sectional area of one or more holes; 10

b) severing means comprising

(1) a blade of sufficient sharpness to sever cleanly the flexible polymeric tube, pipe, or tubular extrudate, the blade being of a thickness slightly smaller than the width of the slit, the blade being of a size to fill the slit at least through the cross-sectional area of the hole in which the flexible polymeric tube, pipe, or tubular extrudate is introduced; 15 20

(2) a holder for the blade which clamps the blade securely, the holder further containing means for contacting the pivot in the block, permitting movement of the holder around the pivot within the plane of the severing means. 25 30

2. The device of Claim 1 wherein the blade is coated with a lubricating fluoropolymer. 35
3. The device of Claim 1 or Claim 2 wherein the blade is a single-edge razor blade containing a reinforcing strip across the top of the blade, the severing edge of the blade being at the bottom, and the blade containing notches at each side, the notches being centered from about one-fourth to about three-fourths of the distance between top and bottom of the blade. 40
4. The device of Claim 3 wherein the block pivot is of a size slightly larger than the notches of the razor blade, the pivot being engaged by one of the notches. 45
5. The device of Claim 1 wherein the pivot attached to the block is a permanent pivot, the holder of the severing means also being attached permanently to the pivot and aligned so that the blade will pass through the slit when the severing device is activated. 50
6. The device of Claim 1 for severing the flexible polymeric tube, pipe, light pipe or tubular extrudate wherein the severance is perpendicular to the sur- 55

face of the flexible polymeric tube, pipe, light pipe or tubular extrudate, wherein the slit in the block is aligned perpendicular to the surface of the flexible polymeric tube, pipe, light pipe or tubular extrudate, and wherein the pivot is aligned perpendicularly to the slit.

7. The device of Claim 1 for cleanly severing the flexible polymeric tube, pipe, or tubular extrudate wherein the severance is not perpendicular to the surface of the linearly extended flexible polymeric tube, pipe, or tubular extrudate, wherein the surface of the light pipe is presented at a non-perpendicular angle to the plane swept by the severing means, wherein the slit in the block is non-perpendicular to the surface of the flexible polymeric tube, pipe, light pipe or tubular extrudate, and wherein the pivot is aligned perpendicularly to the slit.
8. The device of Claim 5 wherein the severing device is attached to the pivot in a manner that the blade edge cannot be openly exposed to human contact while the blade is attached to the holder, and wherein the blade in a resting position is held so that the hole is fully open for introduction of the flexible polymeric tube, pipe, or tubular extrudate.
9. The device of Claim 1 wherein the holding block further contains a rotatable dial, the dial containing one or more holes, the dial holes being of a size slightly larger than the flexible polymeric tube, pipe, or tubular extrudate to be severed, so as to hold firmly the flexible polymeric tube, pipe, or tubular extrudate when introduced through the dial holes, the dial being located so that the dial holes may be aligned with the hole or holes which are completely through the block.

FIG. 1

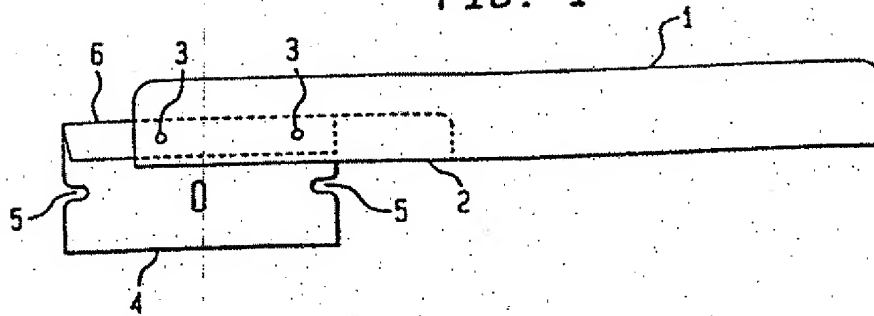


FIG. 2

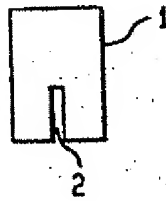


FIG. 3

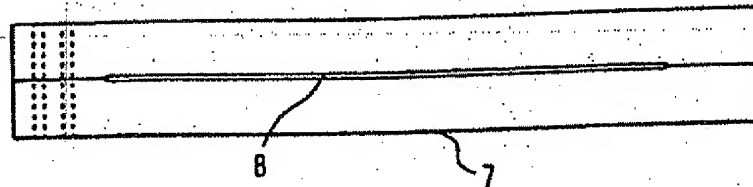


FIG. 4

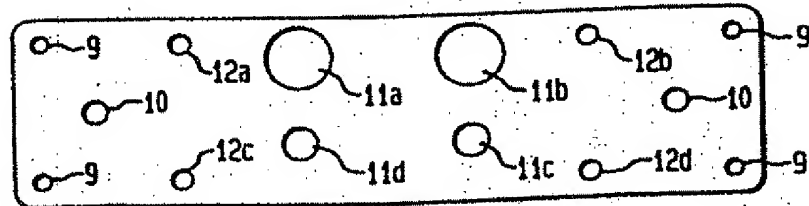




FIG. 5

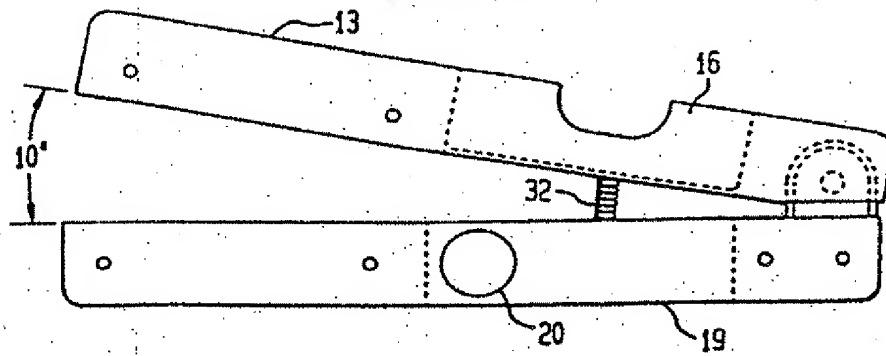


FIG. 6

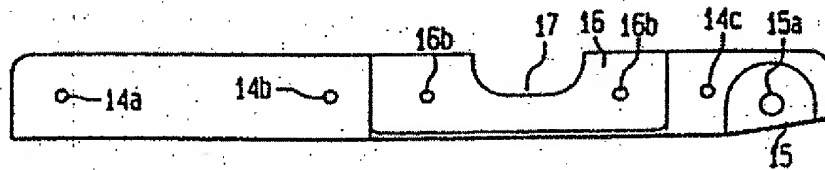


FIG. 7

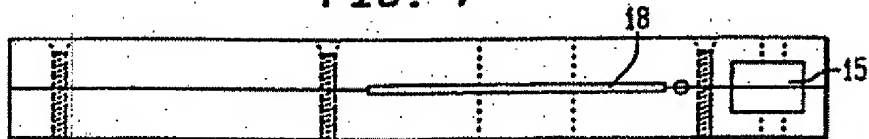


FIG. 8

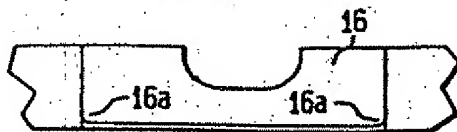


FIG. 9

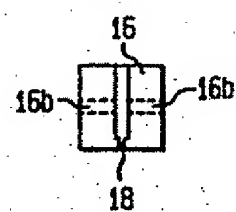


FIG. 10

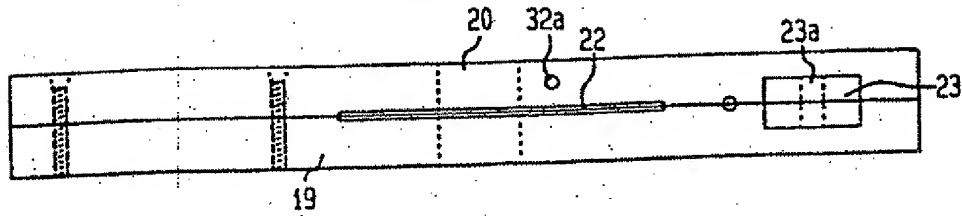


FIG. 11

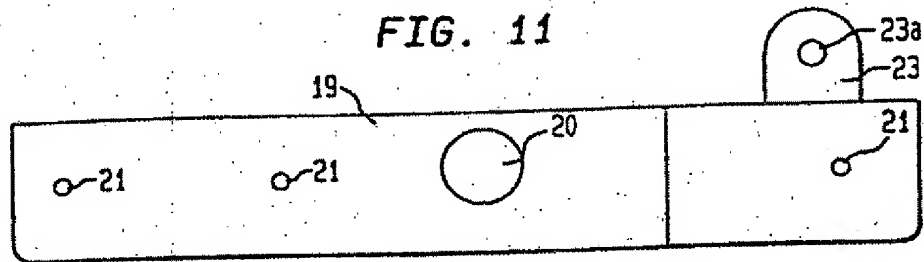


FIG. 12

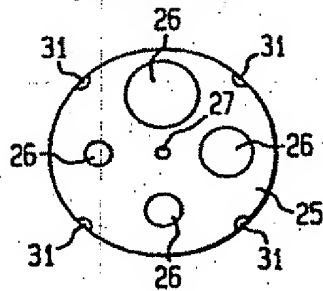


FIG. 13

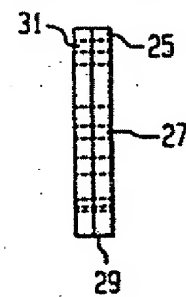
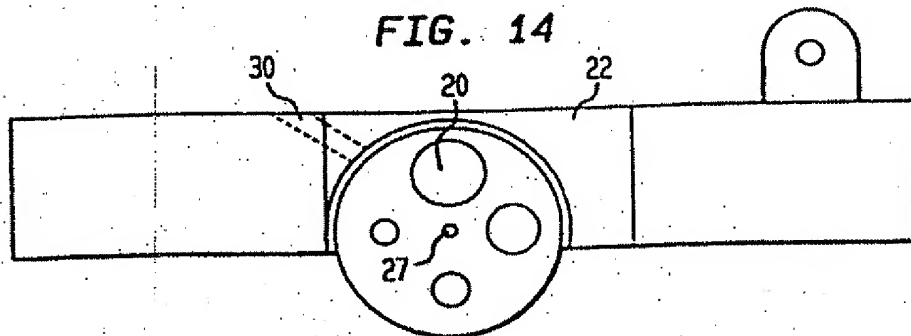


FIG. 14



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 6478

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-5 079 838 (STALLINGS)	1,5,6,8	B26D3/16
Y	* the whole document *	2,3,9	
Y	DE-A-22 22 548 (DR. W. HILLESHEIMER KG) * claim 14 *	2	
Y	US-A-2 486 900 (WILLIS) * column 2, line 46 - column 3, line 20; figures *	3	
Y	METAALBEWERKING, 11 September 1961, pages 196-197, XP002020131 "TOESTEL VOOR HET AFSNIJDEN VAN PIJPJES KUNSTSTOF" * page 196, right-hand column, paragraph 3 - page 197, left-hand column, paragraph 1; figure 132 *	9	
A	US-A-4 247 984 (MC ARDLE ET AL.) * abstract; figures *	4	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
X	WD-A-89 00486 (KOPPELMANS) * the whole document *	1,5,7,8	B26D B26B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 December 1996	Examiner Vaglianti, G
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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